In Situ TEM experiments of irradiation on $Ce_xLa_{1-x}O_{1.5+0.5x}$ Single Crystal

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Microstructure evolution of ceria (CeO_2) during irradiation has been investigated through transmission electron microscopy (TEM) under *in situ* irradiation at IVEM-Tandem facility. CeO_2 doped with 0%, 5% and 25% lanthanum single crystals, grown by molecular beam epitaxy, are used to simulate fluorite-structure UO_2, which is a very important nuclear fuel. 1 MeV krypton ions were irradiated into CeO_2 thin foils at a range of temperatures (room temperature, 600°C and 800°C) to reveal the temperature and impurity concentration effects on defect structure development with the increasing doses (to 5×10^{15} ions/cm^2).

Both temperature effect and composition effect were investigated during *in situ* irradiation experiments. Experiment results show a clear impact of temperature on the growth behaviors of dislocation loops. The comparison of their growth rate and density during irradiation at various temperatures shows the tight correlation between defect diffusion ability and temperature. On the part of impurity effect, it was observed that doped La would decelerate the growth rate of dislocation loops at low concentration (5% La_2O_3) but substantially accelerate the evolution at higher concentration (25% La_2O_3). This trend of dependence of loop growth rate on composition was found to oppositely correlate to the diffusivity of oxygen vacancies in $Ce_xLa_{1-x}O_{1.5+0.5x}$.